Name _____ Date _____ Class _____

Chapter Project Newton Scooters

Imagine what would happen if you and a friend were standing on roller skates and you gave your friend a forward push. What would happen to you? Would you stand still or would you travel backward? The backward motion that you would experience can be explained by Newton's third law of motion, which describes an equal and opposite reaction to every action.

In this project, you will use Newton's third law of motion to design a vehicle. This vehicle must travel forward 1.5 meters by pushing backward on the floor, the air, or some other object. At the close of this project, you will demonstrate your vehicle and explain its features to the class.

Project Rules

- Have your teacher approve your vehicle design plans before you begin construction of your vehicle.
- Your vehicle must use Newton's third law of motion to move forward; it must move forward by pushing backward on the floor, the air, or some other object.
- You must build your vehicle from scrap materials. Don't use a ready-made vehicle.
- Your vehicle must travel forward 1.5 meters and completely cross the finish line. The path of your vehicle should stay within a width of 1 meter.
- You are not allowed to interfere with the movement of your vehicle. You cannot give your vehicle a push as you launch it, and you cannot help it in any way as it travels from the starting line to the finish line.
- You cannot use any form of electricity or the pull of gravity to move your vehicle. This means that you cannot use a downhill ramp to get your vehicle started.
- You may use a "track" such as a toy car track or a string running from the starting line to the finish line to guide your vehicle. Not only will this help reduce friction, but it may also help you to keep your vehicle within the boundaries.
- Your vehicle does not have to move along the ground. If your vehicle moves through the air, you could use a string stretched between two chairs as a "track" to guide your vehicle.
- For the class presentation, you must have diagrams of your vehicle that illustrate the forces that act upon it. You should also be able to explain any modifications that you made to improve the performance of your vehicle.

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Suggested Materials

Here are some ideas for materials to build your vehicle: recycled materials from home, toys or building-block sets, balloons, springs, straws, fishing lines, paper towel rolls

Project Hints

- Be creative! Don't limit yourself to vehicles that have wheels. Think about other ways that you could get your vehicle to move a distance of 1.5 meters. The rules state that the vehicle has to stay within a width of 1 meter, but it is allowed to leave the ground!
- What happens if you inflate a balloon and release it into the air? Can you use Newton's third law of motion to explain this movement? How could you use the balloon's movement to push your vehicle? Can you think of any other objects like this that you could use to push your vehicle?

Project Time Line

Task	Due Date
1. Sketches of possible vehicles completed.	_____
2. Forces of friction and gravity applied to sketches.	_____
3. Newton's third law applied to sketches.	_____
4. One sketch chosen as design for vehicle.	_____
5. Vehicle construction completed.	_____
6. All improvements completed.	_____
7. Class presentation completed.	_____

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Thinking About Newton's Third Law of Motion

Everyday Examples

Newton's third law of motion can be seen in action in many places. In the space provided, describe how this concept explains the following events.

1. An inflated balloon zooms around the classroom when released.

_____

_____

_____

_____

2. A squid squirts through the water without using its fins or tentacles.

_____

_____

_____

_____

3. A salmon swims upstream.

_____

_____

_____

_____

4. A hummingbird stays motionless in the air while flapping its wings.

_____

_____

_____

_____

Power Sources

In designing your vehicle, you will need to apply Newton's third law of motion. List three different ways to power your vehicle. The first one is done for you.

1. An inflated balloon

2. _____

3. _____

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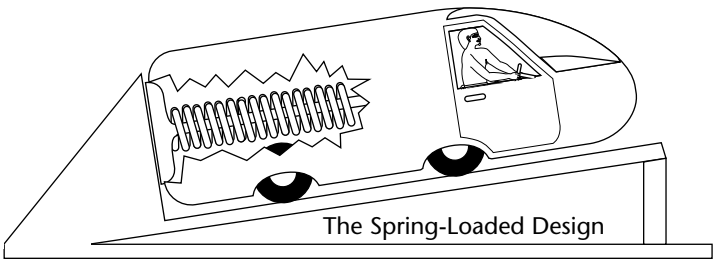
Improving Your Vehicle

New cars aren't released to the public until after they have been tested and modified. Often, this stage of development can take months as the engineers and designers change features on the car to improve performance and safety. After you complete your vehicle, you too will need to spend time modifying your vehicle to ensure that it will travel straight down the course and cross the finish line.

The Spring-Loaded Design

Jeremy decided to use a spring-loaded launcher to power his vehicle. His vehicle will soar off an uphill ramp so there would be less time for friction to act between the vehicle's wheels and the floor of the classroom.



The Spring-Loaded Design

Jeremy thought about different variables that would affect the movement of his vehicle and made a table of these. Can you think of any variables Jeremy left out?

_____

_____

Variable	Ways to Test or Improve Vehicle
Angle of ramp	Test different ramp angles.
Mass of vehicle	Consider different materials for vehicle. Make the vehicle smaller. Don't use wheels.
Type of spring	Experiment with different springs.
Smoothness of ramp	Sand ramp to reduce friction.

Your Own Vehicle

By now you should have sketched a design of your vehicle. Use a table similar to the one above to think of all of the variables that might affect the performance of your vehicle. Indicate experiments that you will want to conduct in order to improve your vehicle's performance.

Lab zone Chapter Project Newton Scooters

In evaluating how well you complete the Chapter Project, your teacher will judge your work in four categories. In each, a 4 is the best rating.

	4	*3*	*2*	*1*
Planning	Student thoroughly considers the forces that would affect the vehicle. Sketch of the vehicle is useful and includes measurements.	Student adequately considers the forces that would affect the vehicle. Sketch of the vehicle is useful.	Student considers some of the forces that would affect the vehicle. Sketch of the vehicle is rough.	Student minimally considers the forces that would affect the vehicle. Sketch of the vehicle not made.
Vehicle Building	Student follows all Project Rules, and work shows evidence of having thoroughly tested and modified the vehicle.	Student follows most of the Project Rules, and work shows evidence of having adequately tested and modified the vehicle.	Student follows some of the Project Rules, and work shows evidence of having tested or modified the vehicle.	Student did not follow many of the Project Rules, and work shows little evidence of having tested or modified the vehicle.
Project Presentation	Presentation is thorough and well organized. Student communicates all appropriate features of the vehicle.	Presentation is adequate. Student communicates most of the appropriate features of the vehicle.	Presentation is appropriate but is hard to follow. Student communicates some of the features of the vehicle.	Presentation is inappropriate and hard to follow. Student communicates a few features of the vehicle.
Group Participation	Student takes a lead in group discussions.	Student participates in all aspects of group discussions.	Student participates in some aspects of group discussions.	Student minimally participates in group discussions.